Urinary iodine excretion and maternal thyroid function. During pregnancy and postpartum

Mohammed Salleh M. Ardawi, Hassan A. Nasrat, Bader E. Mustafa

ABSTRACT

Objectives: To evaluate urinary iodine excretion during the course of pregnancy and postpartum in relation to maternal and neonatal thyroid function parameters in Saudi women living in Jeddah, Kingdom of Saudi Arabia.

Methods: A prospective longitudinal study was conducted on Saudi normal pregnant women during the course of pregnancy (N=80), at term and 6-10 weeks postpartum (N=65), during the period January 1997 through to December 2000. Maternal urinary iodine excretion was determined together with serum levels of total thyroxine, total tri-iodothyronine, free thyroxine, free tri-iodothyronine, thyrotropin, reverse tri-iodothyronine, thyroxine-binding globulin and thyroglobulin. A group of non-pregnant woman (N=200) were included for comparative purposes. Data were also analyzed for significant trends using ANOVA. Neonatal serum levels of total thyroxine, total tri-iodothyronine, free thyroxine, thyrotropin, thyroxine-binding globulin, and thyroglobulin were also measured.

Results: Changes in urinary iodine excretion and in serum thyroid function parameters during the course of pregnancy, at term and postpartum have been demonstrated. Subclinical iodine deficiency was evident in 28.8% of pregnant women at term and 11.5% of women at 6-10 weeks postpartum. Serum total thyroxine and total tri-iodothyronine levels increased in the first trimester ($P<0.001$) and remained elevated at term ($P<0.001$). Serum free thyroxine levels showed a significant decrease by the 2nd trimester ($P<0.001$) and continued to decrease in the 3rd trimester ($P<0.001$). Serum free tri-iodothyronine showed continuous decrease throughout gestation. Thyrotropin levels were decreased during the first and 2nd trimesters ($P<0.001$) but then increased to be comparable to non-pregnant values. Serum reverse tri-iodothyronine increased during the first and 2nd trimesters ($P<0.001$). There was a significant increase in serum thyroxine-binding globulin and thyroglobulin levels during the course of pregnancy. A significant negative correlation between thyrotropin and human chorionic gonadotropin levels was observed throughout pregnancy ($r=-0.31$, $P<0.001$). The observed correlation was stronger ($r=-0.37$; $P<0.001$) in the first trimester as compared to that in the second ($r=-0.164$; $P<0.001$) or the third ($r=-0.125$; $P<0.269$) trimester. There was a negative correlation between maternal free thyroxine and neonatal thyrotropin ($r=-0.70$; $P<0.001$). Positive correlation was found between neonatal total thyroxine and birth weight ($r=0.61$; $P<0.001$) and maternal urinary iodine concentration ($P<0.001$).

Conclusions: The changes in urinary iodine excretion during the course of pregnancy were documented. The decrease in free thyroxine and free tri-iodothyronine and the increase in reverse tri-iodothyronine concentrations during pregnancy resemble the changes in thyroid hormones seen in non-thyroidal illness. Moreover, the changes in thyrotropin in relation to that of human chorionic gonadotropin support the view that the thyroid gland is not primarily thyrotropin driven in early pregnancy. The results suggest that a more complex control may finally regulate maternal thyroid activity; the pituitary and the chorionic systems both function in an independent way in response to possible different feedback stimuli. This could be a physiological adaptation enabling energy conservation during the high metabolic demands of pregnancy. Finally, the

results of the present study point to the need of an increased iodine supply in Saudi pregnant women living in Jeddah, Kingdom of Saudi Arabia to decrease the potential consequences of low iodine intake on maternal thyroid economy.
Saudi Medical Journal 2002; Vol. 23 (4): 413-422

Adequate nutritional iodine supply is important particularly during pregnancy, where the iodine requirement is increased due to enhanced renal clearance and the transfer of iodine from the mother to the fetus, as well as, a greater need of iodine for thyroid hormone synthesis.1,2 In iodine-sufficient areas, physiological losses are not associated with significant changes in the maternal thyroid economy. Conversely, in moderately or marginally low iodine intake areas, pregnancy leads to a relative iodine deficiency state, and constitutes a stimulus for the maternal thyroid function as indicated by relative hypothyroxinemia, increased thyrotropin (TSH) levels during the 2nd part of pregnancy, increased serum thyroglobulin (Tg) and increased maternal thyroid volume.3 However, in severely-iodine-deficient areas, the changes are more pronounced as evidenced by marked hypothyroxinemia, and increased TSH levels which are accompanied by intense maternal and neonatal thyroid stimulation.4,5 The regulation of maternal thyroid function during pregnancy is complex and varies with each stage of pregnancy.2,6 In addition, several studies have indicated a profound influence of maternal thyroid status early in pregnancy on fetal brain and nervous system development,7-9 emphasizing the need for a greater understanding of thyroid physiology and the critical importance of the control mechanisms regulating maternal thyroid function. Biochemical data on free thyroxine (FT4) and TSH levels in pregnancy have often been contradictory. Maternal FT4 concentrations have been variously reported as unchanged, increased, or decreased during pregnancy.10-14 Serum TSH concentrations have been reported to be higher in late than in early pregnancy;15-16 however the concentrations of the hormone in the first trimester have been shown to be higher,16-17 lower12 or unchanged,18 relative to normal control levels. Greater uncertainty of the changes in free-tri-iodothyronine (FT3) in late pregnancy is also commonly reported.16,19 In addition, changes in other thyroid hormone function tests [including total thyroxine (TT4), total tri-iodothyronine (TT3), reverse-T3 (r-T3), thyroxine-binding globuline (TBG)] are variable.2,6,10-14 Moreover, few longitudinal studies have considered the maternal and fetal interaction during the course of pregnancy, in relation to maternal iodine status. Finally, there is very little information on the changes of maternal thyroid function tests in relation to fetal outcome and maternal iodine status in Saudi pregnant women. Thus, the main objective of the present study is to examine urinary iodine (UI) excretion together with the functional activity of maternal thyroid throughout pregnancy, at term and postpartum in healthy Saudi women living in the Jeddah area in relation to fetal outcome.

Methods. A total of 80 Saudi pregnant women living in the Jeddah area participated in the present study. Age and anthropometric data of the women studied are presented in Table 1. The study was carried out during the period of January 1997 through to December 2000, in the Jeddah area. All women had resided in the Jeddah area for more than 5 years and were recruited from women attending antenatal clinics at King Abdulaziz University Hospital (KAUH) and New Jeddah Clinic Hospital (NJCH), Jeddah, KSA. Women with hepatic, renal or with evident endocrine disorders, history of immunosuppresive therapy, history of thyroid dysfunction or on any form of drug treatment were excluded from the present study. In addition, all pregnant women included were: 1. Screened negative for both anti-thyroperoxidase (Anti-TPO) and anti-thyroglobulin (Anti-Tg); and 2. Not smoking cigarette or shessha. Originally, a total of 189 women were examined, but only 80 women fulfilled the criteria for select